

WE CLAIM:

1. A method of characterizing a content traffic flow for communications network Service Level Agreement (SLA) compliance assessment, the method comprising steps of:

5 a. tracking cumulative content arrivals, in real time, for the content traffic flow to derive a time variation of cumulative content arrivals; and

b. adjusting characteristic arrival curve parameters in fitting an arrival curve to the variation of cumulative content arrivals for the content traffic flow,

10 tracking content traffic as received, fitting the arrival curve as content is being received enabling distributed SLA-conformance-assessment-related processing in the communications network.

15 2. The method of providing a content traffic flow characterization as claimed in claim 1, further comprising a step of reporting, in real time, arrival curve parameters to a central entity assessing communications network SLA conformance with respect to the content traffic flow, limiting reporting to arrival curve parameters only providing reporting bandwidth overhead reductions in support of scalable solutions.

20 3. The method claimed in claim 2, wherein reporting arrival curve parameters to the central entity, the method further comprises a step of: including a timestamp specifying the time of the arrival curve fit.

25 4. The method claimed in claim 2, wherein reporting arrival curve parameters to the central entity, the method further comprises a step of: receiving a request for an arrival curve parameter update, reporting arrival curve parameters to the central entity only in response to a request further providing a reduction in the reporting bandwidth overhead.

5. The method claimed in claim 1, wherein tracking cumulative content arrivals for the content traffic flow, the method further comprises a step of: tracking one of cumulative received packets, bits, bytes, words, and double words.

6. The method claimed in claim 1, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: adjusting two arrival curve parameters in fitting a two parameter arrival curve.
7. The method claimed in claim 1, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: adjusting four arrival curve parameters in fitting a four parameter arrival curve.
8. The method claimed in claim 1, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: fitting the arrival curve in accordance with one of a shifted linear regression procedure, and a convex hull fitting procedure.
9. A physical port controller implementing the method claimed in claim 1, comprising a hardware arrival curve generator successively fitting arrival curves to the time variation of cumulative content arrivals for the content traffic flow.
10. A line card implementing the method claimed in claim 1, comprising arrival curve generation means successively fitting arrival curves to the time variation of cumulative content arrivals for the content traffic flow.
11. A communications network node implementing the method claimed in claim 1 comprising one of: a hardware arrival curve generator, and a software arrival curve generator; the communications network node successively fitting arrival curves to the time variation of cumulative content arrivals for the content traffic flow.
12. A method of assessing communications network conformance to a Service Level Agreement (SLA) in respect of a content traffic flow, the method comprising steps of:
 - a. receiving an arrival curve parameter report in respect of a tracked content traffic flow from a network node in real time;
 - b. computing a resource utilization related value based on the received arrival curve parameter report in respect of a content traffic flow pattern and at least one service curve; and

- c. providing a communications network SLA conformance assessment based on the computed resource utilization related value,

receiving arrival curve parameters only enables the provision of a real-time scalable communications network SLA conformance assessment solution.

- 5 13. The method claimed in claim 12, further comprising the prior step of: requesting an arrival curve parameter report.
- 14. The method claimed in claim 12, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving the at least one service curve from storage in respect of the content traffic flow.
- 10 15. The method claimed in claim 12, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving the at least one service curve from a communications network node in a path of the content traffic flow.
- 15 16. The method claimed in claim 12, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving from storage a sequence in which multiple service curves are to be combined with the arrival curve parameters in respect of the content traffic flow.
- 20 17. The method claimed in claim 12, wherein prior to computing resource utilization related values, the method further comprises a step of: discovering a sequence in which multiple service curves are to be combined with the arrival curve parameters in respect of the content traffic flow.
- 18. The method claimed in claim 12, wherein computing resource utilization related values, the method further comprises a step of: computing Quality-of-Service (QoS) parameters.
- 25 19. The method claimed in claim 12, wherein computing resource utilization related values, the method further comprises a step of: convolving an arrival curve respecting the received arrival curve parameters with a service curve.

20. The method claimed in claim 12, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: comparing the computed resource utilization related value with a corresponding agreed upon resource utilization value.

5 21. The method claimed in claim 12, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: selectively modifying communications network operational parameters to ensure that the resource utilization values comply with agreed upon SLA resource utilization values.

10 22. The method claimed in claim 12, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: selectively modifying SLA specified resource utilization values to ensure that the current communications network operation is accommodated in the SLA.

15 23. The method claimed in claim 12, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: providing a proposal for traffic content redirection onto one of existing infrastructure and new to be deployed infrastructure.

20 24. A network management system implementing the method claimed in claim 12 in providing a communications network SLA conformance assessment in respect of the content traffic flow.

25 25. A method of centrally assessing communications network conformance to a Service Level Agreement (SLA) in respect of a content traffic flow, the method comprising steps of:

25 a. tracking cumulative content arrivals for the content traffic flow, in real-time, to derive a time variation of cumulative content arrivals at a communications network node;

25 b. adjusting arrival curve parameters in fitting an arrival curve to the variation of cumulative content arrivals for the content traffic flow,

- c. reporting, in real time, arrival curve parameters to a central entity assessing communications network SLA conformance with respect to the content traffic flow;
- 5 d. receiving an arrival curve parameter report in respect of a tracked content traffic flow at the central entity from a network node in real-time;
- e. computing a resource utilization related value based on the received arrival curve parameter report in respect of a content traffic flow pattern and at least one service curve; and
- 10 f. providing a communications network SLA conformance assessment based on the computed resource utilization related value,

employing arrival curve parameter reporting greatly reducing resource overheads in providing communications network SLA conformance assessments.

- 26. The method claimed in claim 25, wherein reporting arrival curve parameters to the central entity, the method further comprises a step of: including a timestamp specifying the time of the arrival curve fit.
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- 27. The method claimed in claim 26, wherein reporting arrival curve parameters to the central entity, the method further comprises a step of: receiving a request for an arrival curve parameter update, reporting arrival curve parameters to the central entity only in response to a request further providing a reduction in the reporting bandwidth overhead.
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- 28. The method claimed in claim 25, wherein tracking cumulative content arrivals for the content traffic flow, the method further comprises a step of: tracking one of cumulative received packets, bits, bytes, words, and double words.
- 29. The method claimed in claim 25, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: adjusting two arrival curve parameters in fitting a two parameter arrival curve.
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30. The method claimed in claim 25, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: adjusting four arrival curve parameters in fitting a four parameter arrival curve.

31. The method claimed in claim 25, wherein adjusting arrival curve parameters in fitting the arrival curve, the method further comprises a step of: fitting the arrival curve in accordance with one of a shifted linear regression procedure, and a convex hull fitting procedure.

32. The method claimed in claim 25, wherein prior to receiving the arrival curve parameter report, the method further comprising the prior step of: requesting an arrival curve parameter report.

33. The method claimed in claim 25, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving the at least one service curve from storage in respect of the content traffic flow.

34. The method claimed in claim 25, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving the at least one service curve from a communications network node in a path of the content traffic flow.

35. The method claimed in claim 25, wherein prior to computing resource utilization related values, the method further comprises a step of: retrieving from storage a sequence in which multiple service curves are to be combined with the arrival curve parameters in respect of the content traffic flow.

36. The method claimed in claim 25, wherein prior to computing resource utilization related values, the method further comprises a step of: discovering a sequence in which multiple service curves are to be combined with the arrival curve parameters in respect of the content traffic flow.

37. The method claimed in claim 25, wherein computing resource utilization related values, the method further comprises a step of: computing Quality-of-Service (QoS) parameters.

38. The method claimed in claim 25, wherein computing resource utilization related values, the method further comprises a step of: convolving an arrival curve respecting the received arrival curve parameters with a service curve.

39. The method claimed in claim 25, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: comparing the computed resource utilization related value with a corresponding agreed upon resource utilization value.

40. The method claimed in claim 25, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: selectively modifying communications network operational parameters to ensure that the resource utilization values comply with agreed upon SLA resource utilization values.

41. The method claimed in claim 25, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: selectively modifying SLA specified resource utilization values to ensure that the current communications network operation is accommodated in the SLA.

42. The method claimed in claim 25, wherein providing a communications network SLA conformance assessment, the method further comprises a step of: providing a proposal for traffic content redirection onto one of existing infrastructure and new to be deployed infrastructure.

43. The method claimed in claim 25, wherein the central entity is a network management system.